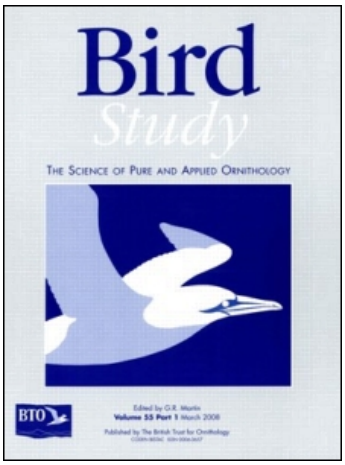

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S. K. Eltringham [a]
[a] The Wildfowl Trust, Slimbridge, Gloucestershire

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The British population of the Mute Swan in 1961

By S. K. Eltringham*

The Wildfowl Trust, Slimbridge, Gloucestershire

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A report to the British Trust for Ornithology

INTRODUCTION

THE MUTE SWAN (*Cygnus olor*) is one of the best known birds in this country and yet surprisingly little is known about even the more elementary aspects of its biology. This is partly due to a prejudice against the study of the Mute Swan on the grounds that it is not a truly wild bird. However, interest in the swan has been stimulated recently by reports of large increases in numbers from various parts of the country. There are few reliable data which confirm these reports but Campbell (1960) quotes the swan-upping figures provided by H.M. Swankeeper for the River Thames between Henley and the Pool of London. In 1948, there were 412 swans on this stretch, but by 1956 numbers had risen to 1,311, an annual increase of nearly 16 per cent. Church (1956) recorded a rise on the River Tweed from 280 swans in 1952 to 372 in 1956.

There was, therefore, some evidence of a substantial increase in the swan population which if genuine would be of economic importance in view of the potential damage to agriculture and other human activities. Concern has been expressed in some quarters that the presumed increase would intensify such damage and there has been pressure for the removal of the protection at present afforded to the swan. Before this could be considered it was clearly desirable that the present status of the Mute Swan should be further investigated. The Home Office asked the Nature Conservancy to pursue the matter and under their aegis, the Wildfowl Trust co-operated with the British Trust for Ornithology to carry out the necessary research. The principal object was to establish whether the increase in the swan population was continuing and, if so, to obtain a reliable figure for the rate of increase. This paper gives the result of a swan census carried out during the spring of 1961. Information, incidental to the census, has provided useful data on the breeding biology of the swan and the extent of the damage which it is alleged to cause.

METHODS

The only available data on the British Mute Swan population before this work were provided by the census carried out by the British Trust

*Present address: Dept. of Zoology, King's College, London.

for Ornithology in the spring of 1955 and repeated on a limited scale in 1956. (Cramp, 1957; Rawcliffe, 1958; Campbell, 1960.) This census attempted to cover every county in England, Scotland and Wales and provides a good estimate of the total population but, inevitably, the cover was poorer in some areas than in others. This, added to the fact that many counties contained few swans in any case, suggested that a further census on such a scale would not be necessary for the purpose of measuring the change in the swan population since 1955. Accordingly, it was decided to repeat the census in a selected number of counties where the previous cover was good or which are of special interest in view of their large swan population. The organisation was similar to that of the earlier census and, as far as possible, the same observers were used. Each county was placed in the care of a local organiser, usually the B.T.O. Regional Representative, who arranged for the distribution of census forms and explanatory leaflets to likely helpers in areas where swans were known to occur. In addition, the census was widely advertised in ornithological and country journals, and a request for help was sent to 115 natural history societies in the census counties. Some 1,800 completed forms were returned to the Wildfowl Trust via the local organisers. Provision was made on the forms for recording the exact locality of nests and herds and for a description of the habitat. Observers were asked to distinguish adults holding territories from those in groups and a separate column was provided for paired swans holding territories but without nests or young. Details of brood and clutch size were also requested. The reverse of the form was set aside for information about damage caused by swans or other points of interest.

The census, which took place in April and May 1961, was conducted in the following counties:

ENGLAND—Buckingham, Cheshire, Devon, Essex, Kent, Leicestershire, Lincolnshire, London, Norfolk, Northumberland, Oxfordshire, Shropshire, Somerset and Wiltshire. (London is taken as the area covered by the London N.H.S., i.e. within a 20 mile radius of St. Paul's.)

SCOTLAND—The Lothians, Fife, Kinross and Stirlingshire.

In addition, an aerial census was made at the same time in 14 counties, of which six were also covered from the ground. The purpose of these aerial surveys was to provide a mutual check on the accuracy of the ground counts and to extend the cover to counties not included in the ground census. Their greatest value, however, lies in the provision of a base-line from which future changes in the swan population can conveniently be measured. The great advantage of aerial survey lies in the rapidity with which the data can be collected and analysed. Observations were made by two observers, one of whom was the pilot, sitting side by side in an Auster aircraft, which is a high wing monoplane providing an excellent downward view. The aeroplane was flown at a height of about 500 ft. above ground level at a speed

of about 85-90 m.p.h. Under these conditions the swans could easily be seen and it was possible to locate nests and count broods from the air. Each county was covered by flying along rivers, canals and coastlines, while in some areas, e.g. the Somerset levels, overland transects were also flown. Large lakes, reservoirs and smaller ponds near rivers were included in the survey, which was completed in 66 flying hours on 19 days. A map of the rivers and transects covered from the air is given in Fig. 1. The following is a list of counties surveyed:

Berkshire, Cambridgeshire, Dorset, Essex,* Gloucestershire, Hampshire, Herefordshire, Norfolk,* Oxfordshire,* Shropshire,* Somerset,* Warwickshire, Worcestershire and Wiltshire.*

The ground and aerial censuses give a figure for the 1961 population in the breeding season and this can be compared with that for 1955. The trends in the swan population in the intervening period can be sketched in from independent sources. Since 1954, the regular national wildfowl counts conducted during the winter months by the Wildfowl Trust (Atkinson-Willes, 1954) have included the Mute Swan. These counts have been analysed by comparing the number of swans seen each month (4–5,000) on a national sample of about 300 waters with the number seen in the comparable month of a master year chosen for the completeness of its data. From these monthly figures, a seasonal index representative of the whole period September–March is calculated by the method devised by Eltringham and Atkinson-Willes (1961).

RESULTS

Ground census. The number of swans recorded during April and May is given for each county in Table I. Paired swans holding territories but without nests or young form an appreciable proportion of the population. The status of these swans is somewhat conjectural as they have been regarded as immature or adult non-breeders by some observers and as failed breeders by others. There is some evidence that reproduction in the swan is not necessarily annual but such behaviour appears to be very limited in extent. Whatever their status, these swans are certainly of significance in reproduction since the territories they occupy are not available to other pairs. The number of all non-breeding swans is more than twice that of the breeding birds.

The gross figures cannot properly be compared with the 1955–56 totals since the cover was not necessarily the same each time. Kent, which was sketchily covered in 1955–56, was included in the present census only because of its research potentialities and may be omitted for comparative purposes. The raw data show only a slight difference with 7,363 swans in 1955 and 7,800 in 1961. A more accurate measure is obtained by confining the comparison to those areas for which the earlier records were sufficiently detailed to ensure that exactly the same cover

*Denotes counties which were also covered from the ground.

FIGURE 1. Routes flown during the aerial swan census 1961. Solid lines—routes following rivers or canals. Dotted lines—overland and coastal routes flown at survey height.

TABLE I—THE NUMBER OF SWANS RECORDED DURING THE GROUND CENSUS IN APRIL AND MAY 1961

	Number of swans			
	Adults holding territory			
County	*Breeding*	*Without nests*	*Non-territorial*	*Total*
Buckingham.	43	3	196	242
Cheshire	94	14	172	280
Devon	156	18	423	597
Essex	120	32	529	681
Kent	314	158	576	1,048
Leicester.	86	16	111	213
Lincoln.	167	15	220	402
London	362	112	755	1,229
Norfolk	235	8	661	904
Northumberland	72	19	262	353
Oxford.	140	38	351	529
Shropshire	144	22	132	298
Somerset	186	28	296	510
Wilts.	256	34	430	720
Fife	58	22	72	152
Kinross	28	—	322	350
East Lothian	46	6	32	84
Midlothian	34	3	93	130
West Lothian	22	—	12	34
Stirling.	38	2	52	92
Totals	2,601	550	5,697	8,848

Note: The odd numbers in some of the totals in the first column are due to the death of one of the parents of a few breeding pairs.

TABLE II—COMPARISON BETWEEN TOTALS RECORDED IN 1955 AND 1961 IN IDENTICAL AREAS

	Breeding swans		*Non-breeding swans*		*Total adults*		*Index 1961*
County	*1955*	*1961*	*1955*	*1961*	*1955*	*1961*	*(1955-6=100)*
Buckingham.	24	22	21	39	45	61	133
Cheshire	43	28	164	139	207	167	81
Devon	66	144	127	178	193	322	167
Essex	50	86	409	454	459	540	117
Leicester.	56	53	102	43	158	96	61
Lincoln.	94	90	224	119	318	209	66
London	156	172	107	110	263	282	107
Norfolk	107	138	343	409	450	547	122
Northumberland	51	56	221	164	272	220	81
Oxford.	74	62	192	140	266	202	76
Shropshire	98	71	94	82	192	153	80
Somerset	146	122	138	147	284	269	95
Wilts.	222	200	134	162	356	362	102
S.E. Scotland	120	152	125	126	245	278	113
Totals	1,307	1,396	2,401	2,312	3,708	3,708	100

Note: Only part of the data from each county can be used in this analysis.

was effected in 1961. These precise comparisons are shown in Table II. This analysis suggests that the slight rise shown by the crude comparison may be due to differences in cover in the two years and not to any real increase in the number of swans. Some counties, notably Devon and Norfolk, show increases but these have been balanced by corresponding declines elsewhere. If numbers had continued to increase since 1955 at a rate of 16 per cent per annum, as suggested by Campbell (1960) for the lower Thames between 1948 and 1956, the 1961 raw total would be about 14,000 instead of 7,800. Clearly an increase of this order has not occurred.

The location of some of the larger herds of swans is shown in Table III. Other large concentrations, although not necessarily in one group,

TABLE III—LOCATION OF HERDS OF OVER 50 NON-BREEDING SWANS, SPRING 1961

County	*Locality*	*Number of swans*
Berks.	Abingdon	84*
	Reading	114*
Cheshire	Chester	67
Dorset	Abbotsbury/Chesil Beach area	331*
	Radipole Lake, Weymouth	151*
Essex	Maldon	85*
	Mistley/Manningtree area	303
	Rainham Marsh	70
Hants.	Christchurch Harbour	119*
	Southampton, R. Itchen	55*
	Southampton (Totton), R. Test	55*
Kent	Rother levels near Wittersham	61
Lincoln.	Wisbech Sewage Farm	70
Middlesex	Hammersmith Bridge	60
	Staines	52
Norfolk	Hickling Broad	320
Oxford.	Oxford	70*
Shropshire	Shrewsbury	53*
Somerset	Bath	79
	Curry Moor	67*
Suffolk	Ipswich	65*
Warwick.	Stratford-on-Avon	62*
Wilts.	Salisbury	55*
Worcester.	Worcester	52*
Kinross	Loch Leven	322
Midlothian	Leith	76

*Aerial survey observation.

were reported on the Exe (62) and Otter (59) estuaries and on the River Clyst above Topsham (68) in Devon; in the Hertford area (84); between Stodmarsh and Grove Ferry (72) in Kent; on the Tweed estuary (75) in Northumberland; on the River Parrett and associated floods between Langport and Ilchester (160†) in Somerset and on the River Wylye below Stoford (66) in Wiltshire. A total of 403 non-breeders was recorded on the River Thames in the London area including 214 between Westminster and Kew.

†Aerial survey figure.

AERIAL CENSUS

For convenience, the results of the aerial census are shown as county totals in Table IV. These are artificial groupings since the surveys were laid out as transects based on river systems, which often form the county boundaries. These totals are not intended to provide data directly

TABLE IV—THE NUMBER OF SWANS RECORDED DURING THE AERIAL CENSUS APRIL AND MAY 1961

County	*Number of swans*			
	Paired	*Single*	*Grouped*	*Total*
Berks.	60	12	224	296
Cambridge.	46	22	223	291
Dorset	314	25	640	979
Essex	134	25	465	624
Gloucester.	114	25	117	256
Hants.	176	20	379	575
Hereford.	58	12	89	159
Norfolk	266	42	459	767
Oxford.	104	32	169	305
Shropshire	120	15	110	245
Somerset	200	21	367	588
Warwick.	98	28	151	277
Wilts.	180	26	240	446
Worcester.	64	18	115	197
Totals	1,934	323	3,748	6,005

comparable with the 1955–56 ground counts, since the latter were incomplete in many of the counties covered, but it is interesting to note that the earlier census produced a total of 6,495 swans for these fourteen counties compared with the 1961 figure of 6,005. This is additional evidence that the population in 1961 was much as it was in 1955.

A detailed comparison between the ground and aerial counts can be made for the six counties in which both methods were applied. The results, given in Table V, are for regions within those counties for which the ground and aerial cover is known to be identical. The close

TABLE V—COMPARISON OF GROUND AND AERIAL COUNTS MADE IN IDENTICAL AREAS IN COUNTIES COVERED BY BOTH METHODS

County	*Number of swans recorded*		$\frac{\text{from air}}{\text{from ground}}$ %
	from ground	*from air*	
Essex	422	459	109
Norfolk	718	674	94
Oxford.	255	222	87
Shropshire	133	132	100
Somerset	333	436	131
Wilts.	461	324	70
Totals	2,322	2,247	97

Note: This analysis shows that the ground and air counts were of comparable efficiency. The large discrepancies in Wiltshire and Somerset may be due to the fact that Wiltshire has many small streams with overhanging trees under which swans could be hidden from the air, whereas Somerset is more open, but has areas difficult to reach and survey on foot.

agreement between the air and ground totals suggests that there is little difference between the accuracy of the two techniques. Neither method, of course, provides an absolute standard. The ground counts are liable to errors of duplication due to the collection of data by several observers over an extended period, while the aerial surveys may miss birds hidden under trees. Estuaries and similar flat terrain offering inadequate viewpoints are notoriously difficult to cover from the ground, and there is no doubt of the superiority of aerial observation under these circumstances. In many places access to river banks is limited or impossible owing to the law of trespass or lack of approach roads but such difficulties do not arise with aerial survey, although there are certain 'control zones' in which movements of aircraft are restricted. Swans are ideal subjects for an aerial census because they are large and white and are not worried by low-flying aircraft. They stand out clearly against their background and can easily be seen from heights of 1,000 ft. or more. In those areas, such as the Somerset levels, where Whooper or Bewick's Swans are sometimes found, it is possible to distinguish them from Mutes on the basis of their carriage, and a confirmatory run at about 100 ft. would show the yellow coloration of the bill. Ground counts of large numbers of swans are often more difficult because of the constant intermingling of individuals coupled with the low elevation of the observer. One weakness of the aerial technique is that all the nests produced during the breeding season in a particular area may not be in existence at the time of the single aerial visit. (The ground census also suffered from this limitation in many cases.) However, perhaps the total number of birds seen from the air in pairs can be taken to represent the proportion of breeders, for although not all paired swans are necessarily nesting, they compensate for the apparent solitary birds which have mates on hidden nests. It seems that these two factors largely cancel each other out since the percentage of paired swans in the aerial total (32 per cent) is of the same order as the percentage of breeding swans in the ground total (29 per cent).

Aerial surveys of the Mute Swan have been carried out with success in other countries. Lundin and Hamson (1956) report a census conducted in Sweden where six aircraft were used. In all, 406 swans and 73 nests were recorded from 65 localities. Winge (1959), describes a nesting survey made from the air in Denmark. The results showed good agreement with ground counts except on the coast where the nests were small and difficult to see from the air. Tarras-Wahlberg (1960), in an account of ground and air surveys of swans in Närke, central Sweden, reports that the second method proved to be more efficient.

NATIONAL WILDFOWL COUNT—WINTER INDEX

The winter indices representing the relative number of swans present between September and March for each winter since 1954–55, are given in Table VI and plotted in Fig. 2. The curve is drawn by eye and gives

TABLE VI—INDICES OF SWANS IN WINTER FOR GREAT BRITAIN BASED ON THE NATIONAL WILDFOWL COUNTS

Winter	*Number of waters considered*	*Number of comparisons made*	*Number of swans counted on these waters during* *Slave year (Column 1)*	*Master year (1957-58)*	*Index*	*Adjusted Index (1955-56 = 100)*
1954-55	230	1,453	15,727	23,036	68	79
1955-56	310	2,043	26,374	30,567	86	100
1956-57	341	1,926	27,108	27,351	99	115
1957-58	MASTER YEAR				100	116
1958-59	320	1,743	26,220	25,623	102	119
1959-60	281	1,507	22,857	20,519	111	129
1960-61	218	1,165	16,541	17,117	97	113
1961-62	25	43	1,331	(1,355)	95 (98)*	110

* The 1961-62 index is provisional and is obtained by comparing September—January, 1961-62 with September—January, 1960-61. The resulting index (98) is corrected to 95 to accord with the 1957-58 master year.

an interpretation of the probable change in swan numbers. The winter of 1957–58 was chosen as the master season because the completeness of its data provides the maximum number of comparisons, but for purposes of comparison with the spring censuses, the indices have been adjusted so that the value for 1955–56 is 100.

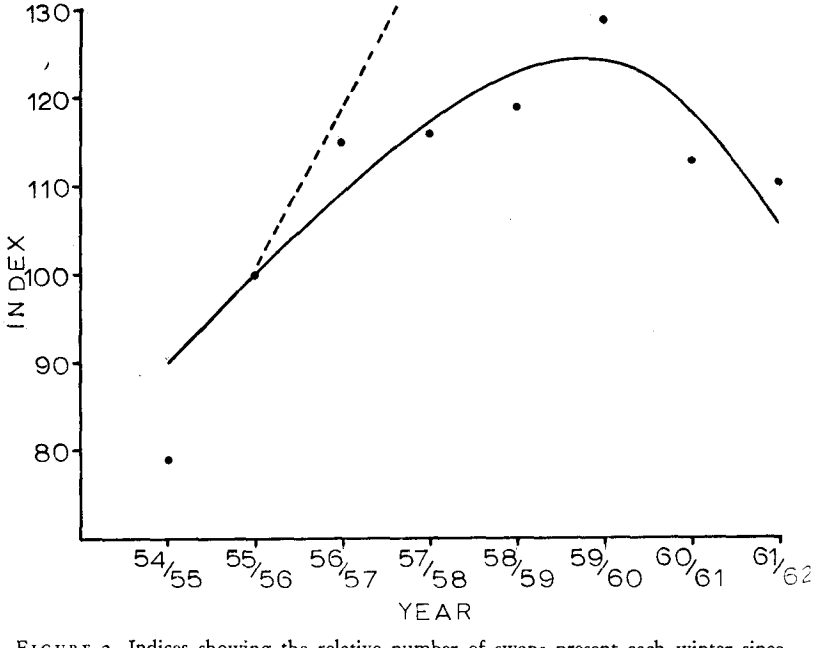

FIGURE 2. Indices showing the relative number of swans present each winter since 1954/55 based on 1955/56 = 100. The 1961/62 index is provisional. The solid line suggests the probable trend in numbers while the broken line shows the increase which would have occurred had the population continued to rise at the rate of 16 per cent per annum suggested by Campbell (1960).

These results show that the swan population may indeed have been increasing at a rapid rate about 1955, but that this increase has now stopped. The rate of increase slowed up considerably after 1956-57 and the number of swans probably reached a peak in 1959. The subsequent decrease has brought the population back to a level not much above what it was in 1955–56. This third body of evidence confirms the conclusion reached on the basis of the ground and air censuses. The results are not strictly comparable with the breeding season censuses since the winter population contains a large number of first year birds and its size is considerably influenced by the previous year's reproduction.

BREEDING DATA FROM THE 1961 CENSUS

In addition to the census figures, much interesting information on the breeding biology of the swan can be derived from the completed census forms. Little information is available on the size of completed clutches for few observers had the opportunity to make close and repeated examinations of the nests. However, 57 nests were so documented and the analysis is displayed as a frequency distribution in Fig. 3. Over half of these nests were found in three counties—Essex (10), Leicestershire

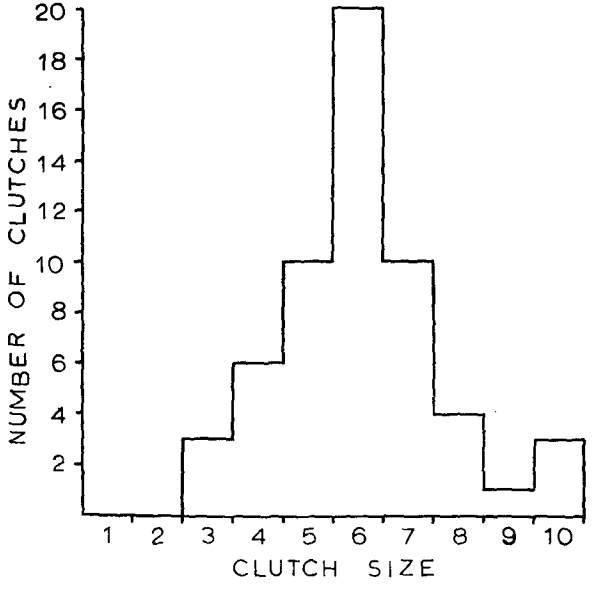

FIGURE 3. Frequency distribution for the clutch size of the Mute Swan, Spring 1961.

(9) and Wiltshire (13). The average clutch size is 6.0 which agrees well with the generally accepted figure of 5-7 eggs per clutch. Campbell (1960) reported an average of 5.9 eggs from 48 clutches with a range from 3 to

10. Paludan and Fog (1956) give a mean of 5.8 for 40 clutches (range 1-10) in Denmark.

Details of broods are more plentiful. These were, of course, recorded early in the breeding season and do not represent the final production for 1961. The number of cygnets to reach the fledgling stage has been investigated by a series of aerial surveys flown over sample transects throughout the summer and autumn of 1961. The results of this work will be published later.

The figures for the early broods are set out by counties in Table VII and the frequency distribution for the country as a whole is given in

TABLE VII—DETAILS OF NESTS AND EARLY BROODS RECORDED DURING THE GROUND CENSUS

County	*Number of nesting pairs*	*Number of nests known to have failed*	*Number of broods recorded*	*Number of cygnets*	*Average brood size*
ENGLAND					
Buckingham.	22	1	17‡	64	4.0
Cheshire	47	16	18	68	3.8
Devon	79	10	24*	76	3.2
Essex	60	4	9	54	6.0
Kent	157	13	76‡	383	5.1
Leicester.	43	10	15*	57	4.4
Lincoln.	84	4	22	108	4.9
London	181	33	60	285	4.8
Norfolk	118	6	64*	309	5.0
Northumberland	36	10	11	53	4.8
Oxford.	70	4	17‡	70	4.4
Shropshire	72	3	23*	75	3.6
Somerset	93	17	36	142	3.9
Wilts.	128	15	58‡	271	4.7
Total England	1,190	146	450	2,015	4.5
SCOTLAND					
Fife	29	6	10	55	5.5
Kinross	14	0	2	7	3.5
East Lothian	23	4	18	66	3.7
Midlothian	17	4	13	61	4.7
West Lothian	11	1	10	41	4.1
Stirling.	19	1	7	28	4.0
Total Scotland	113	16	60	258	4.3
Total Gt. Britain	1,303	162	510	2,273	4.5

* Includes two uncounted broods.
‡ Includes one uncounted brood.

Fig. 4. By comparison with the clutch size it seems that an average of under two eggs per clutch failed to hatch. A slight geographical difference is discernible in the average brood size in England with a tendency for it to be low in the west and high in the east. Few recently hatched broods were seen during the aerial census since most of the aerial

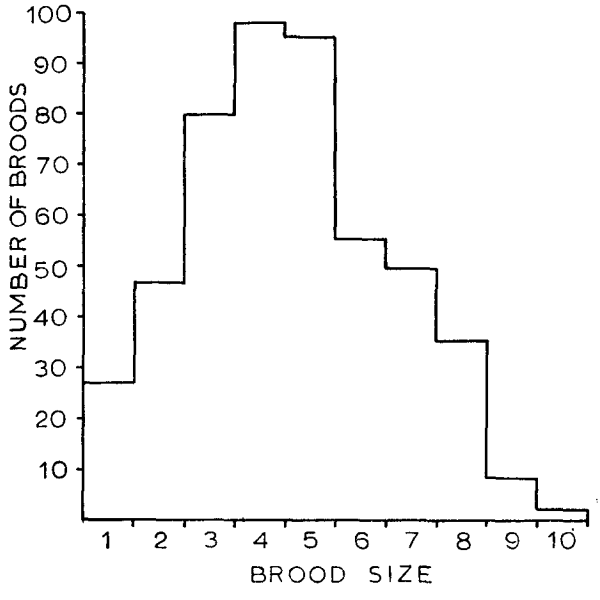

FIGURE 4. Frequency distribution for the brood size of the Mute Swan, Spring 1961. Most broods were recorded in May or early June when the cygnets were probably under one month old.

surveys were completed during the incubation period, but the average size of 24 broods, recorded mainly in East Anglia, was 4.8 with a range of 1-8.

Table VII shows that 12.4 per cent of the nests are known to have failed. In Cheshire the proportion was as high as 33 per cent. The actual proportion lost may have been much higher for the fate of only about one half of the nests was determined (i.e. known to have hatched or failed). Many of the failures early in the season were due to flooding, but afterwards human predation, particularly by small boys or gangs of youths, seemed to be the most important factor. In some areas, however, farmers and landowners practise control by egg destruction. The evidence for nest predation other than by human beings is negligible.

NEST SITES

A classification of nest sites according to the nature of the habitat is given in Table VIII, from which it can be seen that the distribution between running and standing water is about equal. Many of the smaller ponds and gravel pits are close to rivers or streams so that a high proportion of swans breed in the proximity of the river systems. It is clear that coastal breeding sites are at present unimportant in contrast to the situation in Denmark where since 1954 a large number of

TABLE VIII—DISTRIBUTION OF 1,013 SWAN NESTS IN 1961 ACCORDING TO TYPE OF HABITAT (NOTE—INSUFFICIENT DATA WERE GIVEN FOR THE REMAINING 290 NESTS FOR THEM TO BE INCLUDED IN THIS ANALYSIS)

Habitat	*Number of nests*	*Habitat*	*Number of nests*
A. Standing water	(46%) 467	B. Moving water	(49%) 499
1. Lakes and ponds, etc.	287	1. Rivers or streams	346
a. in urban parks	50	2. Canals	63
b. lakes	88	3. Drains	90
c. ponds	110	C. Coastal	(5%) 47
d. broads	15	1. Estuarine	11
e. mill ponds	24	2. Saltmarsh	25
2. Flooded pits	116	3. Seashore	3
3. Reservoirs	50	4. Freshwater lagoon	8
4. Miscellaneous	14		

Total nests classified, 1,013

swans have taken to breeding on the coast (Bruun, 1960). The number of swans nesting in urban areas is quite low, with only about 50 nests in urban parks and perhaps as many again on rivers and canals in towns. This is probably due to a shortage of nesting sites since a very high proportion of the non-breeding population is urban. An analysis of data given in Campbell (1960) shows that of 2,384 nests in 1955, 1,220 (51.2 per cent) were found near standing water, 1,102 (46.2 per cent) by running water and 62 (2.6 per cent) in coastal areas. These proportions are not very different from those recorded in 1961.

DAMAGE BY SWANS

One of the objects of this study was the collection of evidence for and against the allegation that swans cause serious damage to human activities, and space was provided on the census form for such information. This aspect was also mentioned in the notices advertising the census. The material collected, however, is still too slight for statistical treatment although a pattern of swan damage is beginning to emerge. The various types can best be considered under separate headings.

Agriculture. By far the most frequent complaint received during the census was of swans grazing on spring grass which is of considerable value to the farmer. The areas from which such complaints were received were Ayrshire, Dorset, Kent, Oxfordshire, Somerset and Wiltshire, although it is understood that the National Farmers' Union has records of damage in other counties. It is not yet possible to assess the total cost of the damage but it is always extremely localised and can only represent a very small percentage of the national agricultural income. In one instance of a particularly severe attack in Wiltshire, a professional valuer put the loss to the farmer at £75.

Fisheries. Opinion on the swan seems to be divided among anglers; the fly fishermen regard it as an unmitigated nuisance while the coarse fishermen preserve a neutral attitude. During the present investigation

complaints were received from Devon, Hampshire, Hertfordshire, Somerset and Kent. The mere physical presence of a swan can interfere with angling and lines are often broken when swans become entangled in them. In such cases the bird probably experiences greater distress than the angler who could, perhaps, be a little more careful in retrieving broken lines and hooks. These become caught in underwater vegetation and cause much suffering if they are swallowed by a swan feeding on the weed. The practice of scattering ground bait by anglers has caused trouble, since the swans are attracted as readily as the fish. These, however, are minor irritations hardly calling for widespread control of swan numbers. A potentially more serious threat to fishing interests is the destruction of weed during the feeding activities of swans. The loss of the weed, which provides cover for the fish and their insect food, is causing concern on the trout fisheries of southern England. Such damage undoubtedly occurs, but at present only on a minor scale. However, there is evidence of a local increase of the swan population on these rivers, particularly the Test and Itchen, and the position needs to be watched.

No evidence has been received to suggest that swans will deliberately eat fish eggs. Spärck (1957) reports the results of stomach analyses of 73 Mute Swans which were shot on the Danish coast between October 1956 and April 1957 in an attempt to establish whether they were causing harm to fisheries. Food was absent from 6 of the stomachs but of the others, aquatic plant material formed the bulk of the contents. A few specimens of mussel (*Mytilus*), cockle (*Cardium*) and some crustaceans (*Idothea, Sphaeroma*) were found in a few stomachs but these animals had probably been taken by accident along with the plant food. A comprehensive investigation recently completed in Sweden found that concentrations of swans were in no way injurious to coarse fishing (Curry-Lindahl, 1962).

Other waterfowl. Criticism of the swan for its hostility towards other wildfowl comes from two quarters. On the one hand there are the naturalists who prefer ducks and geese to swans, and on the other, the wildfowlers who wish to preserve the ducks, many of which are hand-reared, for shooting. Attacks on other birds, however, are comparatively rare for less than 2 per cent of the census forms reported aggression and in the vast majority of cases swans co-exist peacefully with their neighbours. Many reports were received of ducks nesting peacefully and successfully within a few feet of a swan's nest. Breeding pairs are extremely hostile to other swans, and this animosity may extend to geese and other large waterfowl, but the deliberate attack on ducks and the drowning of ducklings is a habit which occasionally develops in individual birds. Most breeding males will drive away any young remaining from the previous year, but such attacks are rarely serious unless the cygnets are unable to escape.

Swans are sometimes accused of competing with the Brent Goose (*Branta bernicla*) and Wigeon (*Anas penelope*) for eel grass (*Zostera*). Swans will certainly take *Zostera* and 30 per cent of the birds quoted by Spärck (1957) had *Zostera* remains in their stomachs, but there is as yet little evidence to suggest that the swans feed at the expense of the Brent Goose.

Electric cables. The Central Electricity Generating Board reports that electricity failures due to the collision of flying swans with overhead cables are increasing at a rate rather greater than that at which new mileages of cable are being erected. However, they do not seem to regard this as being serious since the number of such breakdowns is very small relative to the total from all causes. Some reduction in accidents has been achieved, particularly over river estuaries, by resiting the cables away from regular swan routes. Alteration of the cable configuration from triangular to flat and the use of game corks to make them more visible have had some success, but the most effective technique is to insulate the cables with *polyvinylchloride* so that a short does not occur if they touch. The general impression is that the electrical authorities have the matter in hand and they are not asking for any specific action against the swan.

DISCUSSION

Both the ground and aerial censuses suggest that the swan population in April and May, 1961 was at about the same level as in 1955. Since these censuses recorded some 12,000 swans, representing two-thirds of the estimated British population of about 19,000 birds, any conclusions reached from them may be taken with confidence to apply to the country as a whole. The results of the independent winter population study support those of the census, although they suggest that numbers have not been static in the intervening period. Fluctuations are more probable in the non-breeding section of the population since mortality factors have a greater effect on closely aggregated herds than on territorial pairs. This is particularly so in cases of death from disease, of which one instance is known from Abberton Reservoir, Essex (Jennings *et. al.*, 1961). This was due to swans weakened by food shortage succumbing to an attack of intestinal parasites. Such catastrophes are probably significant limiting factors in the control of swan numbers in this country since, apart from man and the occasional fox, there are no predators of adult birds. Human activities are responsible for many swan deaths. Among a sample of 400 ringed swans so far recovered, the most frequently reported causes of death were collision with overhead wires (95), parasitism at Abberton (32), collision with vehicles and buildings (20), oil pollution (13), foxes (7) and shooting (5). In over half the recoveries, the cause of death was not apparent but disease may have been responsible for many since it is not often that a properly conducted post mortem can be carried

out. Death from oil pollution would have been much greater but for the work of the R.S.P.C.A. A case of heavy loss through oil pollution was reported from Lincolnshire (A. D. Townsend, *in litt.*), where over 80 swans were destroyed on Brayford Pool, Lincoln and the River Witham when an oil-tanker overturned in 1960 and spilled its load into the river. An even greater disaster occurred in December 1956, when an oil barge sank in the Thames at Battersea and 243 swans died and many more were saved by the R.S.P.C.A. (Anon. 1958). Hard weather can also reduce the population and some swans are known to have died during the cold spell of December 1961—January 1962. There is therefore little support for the frequently heard remark that, because swans die of little but old age, their numbers are bound to increase. In fact, it can be calculated from such mortality data as exist that, when a population is stable, only 20 per cent of fledged young survive to their fourth year, when they first become breeding birds.

As no marked increase of the swan population has taken place since 1955, there seems to be no justification for taking drastic action to limit or reduce the number of swans. The evidence of swan damage, although irrefutable in some localities, is unimpressive in scale. The present regulations, which permit destruction of swans in the event of proven serious damage, would seem to cover any problems.

The lack of a continued increase in the swan population of this country is of interest in view of the situation in continental Europe. In Germany, the swan seems to have reached pest status already, while spectacular increases have occurred since the war in Holland, Denmark, Sweden, Lithuania, Latvia, Estonia, Finland, Poland and Switzerland. There is no direct reason for the continental rise to be reflected in this country; intensive ringing carried out in 1960 and 1961 has provided very little evidence of interchange between British and continental swans. It is possible that the general increase over pre-war numbers has been due to common, underlying causes which have acted independently throughout much of northern Europe.

One of the aspects which the Wildfowl Trust was asked to investigate was possible control by the destruction of eggs. Nest and egg destruction early in the incubation period is not effective as the swans may re-nest elsewhere (Peters, 1936). It was confirmed from the treatment of 144 eggs in 1961 that egg shaking and pricking prevent hatching and allow the bird to continue sitting instead of re-nesting. The method may be criticised on humane grounds because the pen may continue to sit far beyond the normal incubation period and lose a considerable amount of weight. Leaving one egg untouched is no solution since there is no guarantee that the untreated egg will hatch. In one case studied by Major General C. B. Wainwright (*in litt.*), the unshaken egg hatched successfully and the cygnet was

taken off by the cob but the pen remained sitting until the 46th day, when the other eggs were removed to end her vigil. Nest and egg destruction, to be effective, must be continued year after year since most of the eggs will not produce mature birds in any case. This is impracticable on a large scale in view of the vast amount of time and labour involved, but it could be effective locally, e.g. on rivers regularly patrolled by keepers. At present there is no legal basis for such control.

The swan is the largest and also one of the most beautiful of British birds which no one would wish to lose from our fauna. At its present population of about 19,000 birds it can hardly have reached the level of a pest. In many places where it is a nuisance the problem can be resolved by catching the offending swans and releasing them on waters where they can do no harm. A considerable fund of goodwill exists towards the bird, and there are still many places in this country where a pair or two of swans would be very welcome.

SUMMARY

1. Reports of a continued increase in the number of Mute Swans (*Cygnus olor*) in Great Britain led to the organisation of a repeat census in selected counties. The rate of change could be assessed from comparison with the results of an earlier census, conducted in 1955 by the British Trust for Ornithology.

2. The census was conducted from the air and the ground during April and May 1961. A total of 8,848 swans was recorded by the ground census in 14 English and 6 Scottish counties. The aerial surveys found 6,005 swans in 14 English counties, of which six were also covered from the ground.

3. There were more than twice as many non-breeding as breeding swans and 6 per cent were holding territories but were without nests or young.

4. The totals recorded from the ground in 1955 and 1961 in the census counties were 7,363 and 7,800 respectively. A more accurate assessment, in which only areas with identical cover in both years were compared, showed no significant change in numbers.

5. In the six counties covered by both methods, 2,322 swans were recorded from the ground census in places where 2,247 birds were seen from the air.

6. An analysis of winter counts, showed that the population, which had been increasing rapidly in 1955, reached a peak in 1959 and has since declined almost to the 1955 level.

7. A total of 57 completed clutches was reported with an average of 6.0 eggs per clutch.

8. The average size of young broods (mostly under one month old), was 4.5 in England (450 broods) and 4.3 in Scotland (60 broods) giving a national average of 4.5.

9. About 46 per cent of 1,013 nest sites were near standing water, 49 per cent near running water and 5 per cent on or near the coast. Over 12 per cent of the nests were known to have failed. Flooding destroyed many nests early in the season but human predation, chiefly by youths and landowners, was responsible for most losses.

10. The nature and extent of the damage attributed to swans were investigated. Complaints were received of swans grazing on spring grass and depriving fish of food and shelter by stripping the underwater vegetation. Such damage, however, was found to be extremely local in extent. Allegations of attacks on other waterfowl have substance but do not appear to be very serious. Electrical failure due to the collision of swans with power cables is a nuisance but not an important economic problem.

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REFERENCES

ANON. 1958. *London N.H.S. bird report for 1956.* London.

ATKINSON-WILLES, G. L. 1954. *National Wildfowl Counts, 1952–1954.* London.

BRUUN, B. 1960. De ynglende Knopsvaners (*Cygnus olor* (Gm)) fordeling mellem Kysten og indlandet i Danmark 1935-1959. *Dansk. Orn. Foren. Tiddskr.* 54:77-84.

CAMPBELL, B. 1960. The mute swan census in England and Wales, 1955-56. *Bird Study* 7:208-23.

CHURCH, H. F. 1956. The mute swan population of the Eastern Borders. *Bird Study* 3:212-7.

CRAMP, S. 1957. A report on the census of mute swans, 1955 and 1956. *London Bird Report* 21:58-62.

CURRY-LINDAHL, K. 1962. Wildfowl research and conservation in Sweden in 1961. *Wildfowl Trust Thirteenth Annual Report* 25-30.

ELTRINGHAM, S. K. & ATKINSON-WILLES, G. L. 1961. Recent population changes in British ducks. *Wildfowl Trust Twelfth Annual Report* (1961) 40-57.

JENNINGS, A. R. SOULSBY, E. J. L. & WAINRIGHT, C. B. 1961. An outbreak of disease in mute swans at an Essex reservoir. *Bird Study* 8:19-24.

LUNDIN, A. & HAMSON, G. 1956. En inventering ar Knobsvanen (*Cygnus olor*) i Uppland Sommaren 1955. *Vår Fågelvärld* 15:44-8.

PALUDAN, K. & FOG, F. 1956. Den Dansk Ynglebestand af Vildtlevende Knopsvaner in 1954. *Dansk Vildtundersøgelser* 5:3-45.

PETERS, N. 1936. Uber Beobachtungen an den Hamburger Alterschwanen *Cygnus olor* (Gmel.) in den Jahren 1931 bis 1935. *Abh. naturw. Ver. Hamburg, N.F.* 1:195-214.

RAWCLIFFE, C. P. 1958. The Scottish mute swan census 1955–56. *Bird Study* 5:45-55.

SPARCK, R. 1957. An investigation of the food of swans and ducks in Denmark. *Third Cong. Int. Union of Game Biologists* 45-7.

TARRAS-WAHLBERG, N. 1960. Knöbsvanen (*Cygnus olor*) in Närke, 1959. *Vår Fågelvärld* 19:227-35.

WINGE, A. 1959. Knöbsvanen (*Cygnus olor*) i Skane ar 1957. *Vår Fågelvärld* 18:1-11.